REMARKS

The present invention is a method of recovering location information of a subscriber in a mobile network and a program storage device readable by a machine, tangibly embodying a program of instructions executable by the machine to perform a method of recovering location information of a subscriber in a mobile network. The invention provides protection against the loss of a Transport Address (TA) which is a current Care of Address of a mobile Subscriber from loss. See paragraph [0005] of the Substitute Specification. The TA is defined as the Care of Address which is an IP address associated with a mobile node while the subscriber is visiting a particular foreign link. See paragraph [0021] of the Substitute Specification.

Claims 1-14 stand rejected under 35 U.S.C. §103 as being unpatentable over United States Patent 6,097,942 (Laiho) in view of United States Patent 5,463,672 (Kage). With respect to independent claims 1, 5, 8, and 12, the Examiner reasons as follows:

> Regarding claims 1, 5, 8 and 12, Laiho teaches a method of recovering location information of a subscriber in a mobile network (see column 3, lines 19-22), the method comprising: forwarding a registration request from the subscriber to an S-CSCF (Serving-Call State Control Function) including subscriber's identifier (column 10, lines 8-31, see "location registration request" and see "including the mobile station IMSI identifier"), forwarding a location update from the S-CSCF to an HSS (Home Subscription Server) (also see column 10, lines 8-31, see "location update information to the HLR") including the S-CSCF address (see column 5, lines 63-67 and see column 6 line 65 to column 7 line 7), and storing data including the subscriber's in the HSS so as to be protected against loss (see column 2, lines 42-55).

> Laiho does not specifically disclose a registration request from the subscriber to an S-CSCF (Serving-Call State Control Function) including subscriber's TA (Transport Address) and a location update including the subscribers TA.
>
> Kage teaches a registration request from the subscriber to an S-CSCF (Serving-Call State Control Function) including subscriber's TA (Transport Address) (see column 2, lines 9-16) and a location update including the subscribers TA (see column 5, lines 27-34).
>
> Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide the teaching of Kage into the system of Laiho in order to provide a personal mobile telephone system that is low cost and automatically establish a full-duplex connection (see Kage, column 1, lines 45-48).

With respect to Laiho, it is submitted that the Examiner's conclusions regarding the S-CSCF, including storage of a S-CSCF address, are incorrect. While Laiho does describe reinstating and updating of a mobile subscriber identification location in column 1, lines 51-63, a process of restoring mobile subscriber service information in column 3, lines 19-25, and the updating of a location of a mobile station in a visiting location register (VLR) in column 9, lines 51-67, through column 10, lines1-31, such disclosure does not correspond to the S-CSCF and Home Subscriber Server (HSS) of the claims and the functions thereof. It is submitted that Laiho discloses updating between a home location register (HLR) and a VLR which does not correspond to the claimed function of the S-CSCF and HSS.

The Examiner correctly acknowledges that Laiho does not disclose forwarding a registration request from the subscriber to a S-CSCF, including the subscriber's Transport Address, and forwarding a location update from the S-CSCF including the

subscriber's TA. In fact, each of the independent claims is more specific than the Examiner has acknowledged in that the recitation forwarding a location update from the S-CSCF to a Home Subscriber Server (HSS) including the subscriber's TA as recited in independent claims 5 and 12 and including an address of the S-CSCF as recited in independent claims 1 and 8. Kage does not cure this deficiency.

Kage discloses a personal mobile communication system wherein telephone calls are sent from the Public Switch Telephone Network (PSTN) to mobile terminals 10 in a wireless network, such as depicted in Figs. 1 and 6. However, there is no disclosure in Kage, as suggested by the Examiner, of a registration request from the subscriber to a S-CSCF including the subscriber's TA which is the current Care of Address and forwarding a location update including the subscriber's TA.

The Examiner has cited column 2, lines 9-16 and column 5, lines 27-34, for the above disclosure of Kage regarding registration and location update. All that is described in column 2, lines 9-16, is that a position registration memory receives and stores a position registration request sent from a base station to the memory, selects one of the base stations identified by a base station identifier stored in the memory, responds to a call set up signal from the PSTN, and broadcasts the base station identifier as well as a copy of the PSTN user and the mobile user address codes contained in the call-setup signal which does not correspond to forwarding a registration request from the subscriber to a Serving-Call State Control Function (S-CSCF) including the subscriber's Transport Address (TA) which is a current Care of Address of the subscriber and forwarding a location update from the S-CSCF to a Home Subscription Server (HSS) including the subscriber's TA, as claimed in

claims 5 and 12, and furthermore, an address of the S-CSCF as recited in independent claims 1 and 8. In fact, Kage does not even describe the utilization of a S-CSCF and a subscriber's TA which is a current Care of Address of the subscriber as claimed.

Accordingly, if the proposed combination of Laiho and Kage were made, the claimed subject matter of the invention would not be achieved. Neither Laiho nor Kage discloses the architecture of the claimed methods and program storage devices involving a S-CSCF, a TA, a current Care of Address of the subscriber and a HSS and furthermore, storing the subscriber's TA in the HSS so as to be protected against loss. If the Examiner is suggesting that the aforementioned entities are inherent, it is requested that on the record he clarify his position since it is submitted that there is no teaching in Laiho or Kage regarding the claimed entities and the functionality thereof regarding the TA and the HSS.

Dependent claims 2, 6, 9, and 13 further respectively limit independent claims 1, 5, 8 and 12 in reciting that upon the S-CSCF losing data, lost data including the subscriber's TA may be restored to the S-CSCF from the data stored in the HSS. The Examiner relies upon column 3, lines 19-25, of Laiho which merely refer to the restoring of data in a mobile communications database being simplified by Laiho. However, as pointed out above, it is submitted that Laiho does not even teach the subject matter which the Examiner has contended is taught by Laiho and furthermore, as has been pointed out above, Kage does not cure the deficiencies thereof. Moreover, column 9, lines 51-67, through column 10, lines 1-31, as referred to above, which describe the updating of location information, do not suggest restoring of data in a S-CSCF from data stored in a HSS.

Dependent claims 3 and 10 further respectively limit dependent claims 1 and 8 in reciting storing data in the HSS comprises storing data in a non-volatile memory in the HSS. These claims are patentable for the same reasons set forth above with respect to claims 1 and 8.

Dependent claims 7 and 14 further limit dependent claims 6 and 13 in reciting the storing of data in the non-volatile memory in the S-CSCF comprises storing data in a hard disk drive. Claims 7 and 14 are patentable for the same reasons set forth above with respect to claims 6 and 13.

Claim 4 further limits claim 3 in reciting that the non-volatile memory in the HSS is a hard disk drive. Claim 3 is patentable for the same reasons set forth above.

Claims 15, 19, 21 and 25 stand rejected under 35 U.S.C. §103 as being unpatentable over Laiho in view of United States Patent 6,411,632 (Lindgren et al). These grounds of rejection are traversed for the following reasons:

Claim 15 recites:

> A method of recovering location information of a subscriber in a mobile network, the method comprising:
> upon a Serving-Call State Control Function (S-CSCF) receiving a call setup request for the subscriber from a Interrogating-Call State Control Function (I-CSCF), forwarding a route request to a User Mobility Server (UMS)and receiving a home address of the subscriber;
> forwarding the call setup request from the S-CSCF to a home agent at the home address of the subscriber;
> forwarding the call setup request from the home agent to the subscriber; and
> forwarding an address update from the subscriber to the S-CSCF.

and

Claims 19 recites:

> A method of recovering location information of a subscriber in a mobile network, the method comprising:
> upon an Interrogating-Call State Control Function (I-CSCF) receiving a call setup request for the subscriber, forwarding a route request to a User Mobility Server (UMS) and receiving a home address of the subscriber;
> forwarding the call setup request from the I-CSCF to a home agent at the home address of the subscriber;
> forwarding the call setup request from the home agent to the subscriber; and
> forwarding an address update from the subscriber to the I-CSCF.

Claims 21 and 25 recite a program storage device for performing the method respectively of claims 15 and 19.

The Examiner's construction of Laiho as disclosing a S-CSCF and I-CSCF is traversed for the reasons set forth above. Laiho does not disclose any of a S-CSCF, an I-CSCF and a UMS as recited in independent claims 15 and 21 and furthermore, does not disclose an I-CSCF as recited in independent claims 19 and 25. It is submitted, as discussed above, that Laiho does not disclose anything corresponding to Serving-Call State Control Functions (S-CSCF) and Interrogating-Call State Control Function (I-CSCF) alone or in combination with a UMS.

If the Examiner persists in the stated construction of Laiho, it is requested that he point out on the record where the aforementioned entities are found.

Moreover, it is submitted that the functions of the aforementioned entities are not described in Laiho. Therefore, if the Examiner contends that the functions of the S-CSCF, I-CSCF and UMS are disclosed in Laiho, it is requested that he also point

out on the record where the functions of the entities which the Examiner contends to be present in Laiho are performed.

The Examiner's reference to column 10, lines 8-31, which has been discussed above, merely describes the updating of a current location area from a VLR to a HLR. It is submitted that this disclosure would not motivate a person of ordinary skill in the art to obtain the claimed S-CSCF, I-CSCF and a UMS as contended by the Examiner to be taught in column 10, lines 8-31 and furthermore, the functionality recited therein.

The Examiner has cited Lindgren et al for the forwarding of a call setup request from the home agent to the subscriber with the Examiner relying upon column 5, lines 27-34, and Fig. 4. What is described therein is a series of communications between the mobile subscriber and a VLR, network hub and HLR. What is disclosed in the cited portion of column 4, is the TCP/IP layer replacing the MTP layer and the SSCP layer. It is not understood what the Examiner considers the home agent to be, nor how the cited portion teaches forwarding the call setup request from the home agent to the subscriber. Accordingly, it is submitted that Lindgren et al do not teach the forwarding of a call setup request from the home agent to the subscriber as recited in the independent claims. Therefore, if the proposed combination were made of Laiho and Lindgren, it is submitted that the subject matter of the independent claims would not be obtained.

Moreover, it is submitted that the Examiner's proposed combination is based upon impermissible hindsight. The Examiner has not demonstrated on the record any motivation why a person of ordinary skill in the art would be led to combine the teachings of Laiho and Lindgren et al.

Dependent claims 16-18, 20, 22-24 and 26-28 stand rejected under 35 U.S.C. §103 as being unpatentable over Laiho in view of Lindgren et al and further in view of United States Patent 6,587,822 (Inoue et a). Inoue et al has been cited for forwarding the request to a UMS which comprises forwarding an indication to the UMS that the S-CSCF fails to have a Care of Address of the subscriber.

In the first place, Inoue et al do not cure the deficiencies noted above with respect to the proposed combination of Laiho and Lindgren et al.

Moreover, column 19, lines 29-35, refer to a Care of Address as prepared by a PPP (Point-to-Point Protocol) Server with the address leasing request being described as transmitted from mobile computer management server 5 of the nearby or selected visited site network so as to try to acquire the temporal address. It is submitted that this disclose does not suggest the subject matter of claims 16, 22, and 26 which further limit claims 15, 21 and 25 in reciting forwarding the route request to the UMS comprises forwarding an indication to the UMS that the S-CSCF fails to have a Care of Address. It is requested that if the Examiner persists in the stated ground of rejection, he point out on the record how the statement upon which the Examiner has relied in Inoue et al in column 19 regarding a Care of Address involving a PPP Server would suggest the claimed function in the context of the recited architecture in dependent claims 16, 22 and 26.

Moreover, with respect to claims 17, 18, 20, 23, 24, 27 and 28, the Examiner further cites the same portion of Inoue et al regarding the Care of Address. It is submitted that the aforementioned disclosure of Inoue et al regarding a Care of Address would not motivate a person of ordinary skill in the art to achieve the subject matter of claims 17, 18, 20, 23, 24, 27 and 28.

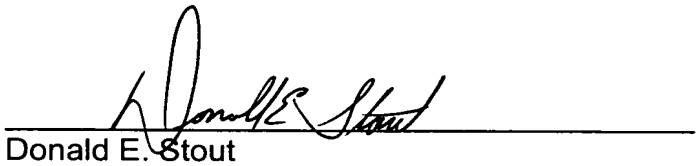
In summary, it is submitted that the rejection of claims 16-18, 20, 22-24, and 26-28 is erroneous for the reason that, if a proposed combination were made, the claimed subject matter would not be achieved in that Inoue et al do not teach the claimed Care of Address in the context of the architecture recited in the rejected claims. Moreover, it is submitted that the proposed combination is based upon impermissible hindsight.

In view of the foregoing amendments and remarks, it is submitted that each of the claims in the application is in condition for allowance. Accordingly, early allowance thereof is respectfully requested.

To the extent necessary, Applicants petition for an extension of time under 37 C.F.R. §1.136. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account No. 01-2135 (0172.38738X00) and please credit any excess fees to such Deposit Account.

Respectfully submitted,

ANTONELLI, TERRY, STOUT & KRAUS, LLP



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Attachments

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SUBSTITUTE SPECIFICATION

RECOVERY TECHNIQUES IN MOBILE NETWORKS

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to recovery techniques for use in mobile networks. More particularly, the present invention relates to protecting the Transport Address (TA) which is a current Care of Address of a mobile subscriber is reachable from loss and after Call State Control Function (CSCF) crashes and after reset situations of a network element realizing CSCF functionality.

Description of the Related Art

[0002] Technical Report TR 23.821 V1.0.1, published July 2000 by the 3rd Generation Partnership Project (3GPP) and available on the Internet at http://www.3gpp.org, discloses the specifications of a 3G All-IP mobile network and this report is incorporated by reference herein in its entirety.

[0003] Figure 1 illustrates the architecture of the network disclosed in the above-noted Technical Report. The elements shown with asterisks are elements which have been duplicated for figure layout purposes only. These duplicated elements belong to the same logical element in the reference model.

[0004] Unfortunately, the network disclosed in the Technical Report fails to include any protection of the TA of a 3G All-IP subscriber from loss. Furthermore, the network disclosed in the Technical Report fails to protect the IP address of a subscriber in the case of a reset situation of a

network element realizing CSCF functionality, that is, a CSCF, thereby preventing recovery after a reset of the network element. Still furthermore, the network disclosed in the Technical Report fails to protect the location information of a subscriber after a CSCF crash, thereby preventing recovery after a CSCF crash.

SUMMARY OF THE INVENTION

[0005] An object of the present invention is to provide a technique for recovering location information of a subscriber in a mobile network including forwarding a registration request from the subscriber to an S-CSCF including the subscriber's TA and then forwarding an AL (Application Level) location update from the S-CSCF to ~~an~~ a Home Subscriber Server (HSS) including the subscriber's TA and the (S-CSCF) address and storing data including the subscriber's TA and the S-CSCF address in the HSS so as to be protected against loss.

[0006] Another object of the present invention is to provide a technique for recovering location information of a subscriber in a mobile network including forwarding a registration request from the subscriber to an S-CSCF including the subscriber's TA and then forwarding an AL location update from the S-CSCF to an HSS including the S-CSCF address and storing data including the subscriber's TA in a non-volatile memory of the S-CSCF so as to be protected against loss.

[0007] Yet another object of the present invention is to provide a technique for recovering location information of a subscriber in a mobile network including upon an S-CSCF receiving a call setup request for the subscriber from an Interrogating Call State Control Function (I-CSCF), forwarding a route request to a User Mobility Server (UMS) and receiving a home address of the subscriber and then forwarding the call setup request from the S-CSCF to a home agent at the home

address of the subscriber and then forwarding the call setup request from the home agent to the subscriber and subsequently forwarding an address update from the subscriber to the S-CSCF.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] The foregoing and a better understanding of the present invention will become apparent from the following detailed description of example embodiments and the claims when read in connection with the accompanying drawings, all forming a part of the disclosure of this invention. While the foregoing and following written and illustrated disclosure focuses on disclosing example embodiments of the invention, issued a clearly understood that the same is by way of illustration and example only and the invention is not limited thereto. The spirit and scope of the present invention are limited only by the terms of the appended claims.

[0009] The following represents brief descriptions of the drawings, wherein:

[0010] Figure 1 illustrates the architecture of a 3G All-IP mobile network.

[0011] Figure 2 illustrates reaching a called party after losing LA (Location Area) information in a legacy mobile network.

[0012] Figure 3 illustrates failure to reach a called party after losing TA information in a 3GPP All-IP mobile network.

[0013] Figure 4A illustrates sending subscriber TA to S-CSCF and then forwarding it to HSS at registration.

[0014] Figure 4B illustrates an example of reaching a called party after losing TA information in a mobile network in accordance with the present invention.

[0015] Figure 5 illustrates the signal flow in the case of a recovery after a CSCF crash in accordance with another embodiment of the present invention.

DETAILED DESCRIPTION

[0016] Before beginning a detailed description of the subject invention, mention of the following is in order. When appropriate, like reference numerals and characters may be used to designate identical, corresponding, or similar components in differing drawing figures. Furthermore, in the detailed description to follow, example sizes/models/values/ranges may be given, although the present invention is not limited thereto. Lastly, other components may not be shown within the drawing figures for simplicity of illustration and discussion and so as not to obscure the invention.

[0017] In the application level of a 3G All-IP network, the reachability of a subscriber is maintained in two levels, namely, the network element level and the subscriber level. The S-CSCF that the subscriber is currently registered to and the TA of the roaming subscriber, which the subscriber provides to the network during Application Level (AL) registration, must be known to and maintained by the network.

[0018] Without specific support for mobility in IPv6, packets destined to a mobile subscriber would not be able to reach it while the subscriber is away from its home link (the link on which its home IPv6 subnet prefix is in use), since routing is based on the subnet prefix in a packet's destination IP address. In order to continue communication in spite of its movement, a subscriber could change its IP address each time it moves to a new link, but it would then not be able to maintain transport and higher-layer connections when it changes location.

[0019] Mobile IPv6 allows a subscriber to move from one link to another without changing its IP address. A subscriber is always addressable by its "home address", an IP address

assigned to it within its home subnet prefix on its home link. Packets may be routed to the subscriber using this address regardless of its current point of attachment to the Internet, and it may continue to communicate with others after moving to a new link. The movement of a subscriber away from its home link is thus transparent to transport and higher-layer protocols and applications.

[0020] A mobile subscriber is always addressable by its home address, whether it is currently attached to its home link or is away from home. While it is at home, packets addressed to its home address are routed to it using conventional Internet routing mechanisms in the same way as if it were never mobile. Since the subnet prefix of its home address is the subnet prefix (or one of the subnet prefixes) on the subscribers' home link (it is the mobile subscribers' home subnet prefix), packets addressed to it will be routed to its home link.

[0021] While a subscriber is attached to some foreign link away from home, it is also addressable by one or more care-of addresses, in addition to its home address. A care-of address is an IP address associated with a mobile node while the subscriber is visiting a particular foreign link. The subnet prefix of a subscriber's care-of address is the subnet prefix (or one of the subnet prefixes) on the foreign link being visited by it; if it is connected to this foreign link while using that care-of address, packets addressed to this care-of address will be routed to the subscriber in its location away from home.

[0022] The association between a subscriber's home address and care-of address is known as a "binding" for the subscriber. It typically acquires its care-of address through stateless or stateful Address Autoconfiguration, according to the methods of IPv6 Neighbor Discovery. Other methods of acquiring a care-of address are also possible, such as static preassignment by the owner or manager of a particular foreign

link, but details of such other methods are beyond the scope of this discussion.

[0023] While away from home, a mobile subscriber registers one of its care-of addresses with a router on its home link, requesting this router to function as the "home agent" for it. This binding registration is done by the subscriber sending to the home agent a packet containing a "Binding Update" destination option; the home agent then replies to the subscriber by returning a packet containing a "Binding Acknowledgment" destination option. The care-of address in this binding registered with its home agent is known as the subscriber's "primary care-of address". The subscribers' home agent thereafter uses proxy Neighbor Discovery to intercept any IPv6 packets addressed to the subscribers' home address (or home addresses) on the home link and tunnels each intercepted packet to the subscribers' primary care-of address. To tunnel each intercepted packet, the home agent encapsulates the packet using IPv6 encapsulation, with the outer IPv6 header addressed to the subscribers' primary care-of address.

[0024] Keeping the address of the S-CSCF ensures that a call to a subscriber can be routed to the destination node, that is, the S-CSCF. Keeping the current TA of the subscriber ensures that a call made to the subscriber which arrives at the S-CSCF can finally reach the subscriber.

[0025] As illustrated in Figure 2, in legacy mobile networks, such as GSM, the information on the serving MSC/VLR (stored in the HLR) is adequate. That is, the called party can be reached even after the loss of the subscriber location area (LA) information by a searching/paging mechanism. In step 1, the current V-MSC/VLR for a called party is first located and in step 2 a setup toward the V-MSC/VLR is performed. In step 3, upon a loss of the LA information, the called party is paged in all cells under the V-MSC/VLR.

[0026] On the other hand, as illustrated in Figure 3, in the 3G All-IP network, no such searching mechanism is available, so that the information of the current S-CSCF (stored in the HSS) is insufficient to reach the subscriber upon the loss of the subscriber TA. In step 1, S-CSCF is located and in step 2 a setup toward the S-CSCF is performed. However, in step 3,in the absence of the TA of the called party, the called party is not reachable.

[0027] The applicants have determined that the TA of a 3G All-IP subscriber should be protected against loss with the same level of security as that for the Serving CSCF (S-CSCF). The applicants have proposed options to protect the TA of a subscriber, namely, one option in which the TA is forwarded to the ~~Home Subscription Server (HSS)~~ and another option in which there is a security backup of the TA within the CSCF. The TA of the subscriber should be forwarded to the HSS at registration and downloaded from the HSS to the S-CSCF during recovery. Still another option is to have a permanent IPv6 (Internet Protocol Version 6) address allocated to the subscriber and to have the subscriber update its current Care-of Address (part of the TA) to the Home Agent upon obtaining the current TA.

[0028] As noted above, in accordance with the present invention, various options are available for implementing protection and recovery of the subscriber TA.

[0029] In the first option, as illustrated in Figure 4A, "a safe copy" of the subscriber's TA is forwarded to the HSS for storage and protection. The TA must enjoy the same level of protection against loss as the S-CSCF address. The TA and other data can then be restored to the S-CSCF upon the earlier loss of the data by the S-CSCF. It is noted that the subscriber's TA is stored in the S-CSCF for normal operation. An incoming call from an REP (Remote End-Point) is received by the S-CSCF in step 1. In step 2, the S-CSCF looks for the

subscriber's TA so as to route the call but fails to find the subscriber's TA. In step 3, the S-CSCF initiates the restoration of the subscriber's TA (and possibly other data) from the HSS. This option is only available when the S-CSCF loses only the TA of the subscriber. Finally, in step 4, the call is then routed to the subscriber using the recovered TA.

[0030] As illustrated in Fig. 4B in ~~In~~ step 1, the registering subscriber forwards an AL registration request to the S-CSCF including the TA. ~~and in~~ In step 2, an AL Location Update is forwarded to the HSS including the TA and S-CSCF address. In step 3, the HSS stores the updated TA and S-CSCF address (in a hard disk, for example, or other non-volatile memory). ~~and in~~ In step 4, the HSS forwards an AL Location Update acknowledgement to the S-CSCF which stores the TA and subscription profile and other data. ~~In step 6, the S-CSCF forwards an AL registration acknowledge to the registering subscriber.~~

[0031] As illustrated in Fig. 4B an incoming call from an REP (Remote End-Point) is received by the S-CSCF in step 1. In step 2, the S-CSCF looks for the subscriber's TA so as to route the call but fails to find the subscriber's TA. In step 3, the S-CSCF initiates the restoration of the subscriber's TA (and possibly other data) from the HSS. This option is only available when the S-CSCF loses only the TA of the subscriber. Finally, in step 4, the call is then routed to the subscriber using the recovered TA.

[0032] In the second option, the same level of protection against loss applies for the subscriber's TA stored in the S-CSCF as that of the S-CSCF address stored in the HSS. For example, the subscriber's TA can be backed up in a hard disk, or other non-volatile memory in the S-CSCF.

[0033] In the case of an S-CSCF crash, when the S-CSCF restarts, all of the information regarding the mobile subscribers registered with it, including the information on

how to reach the mobile subscribers, is lost. In such a situation, it is not possible to deliver mobile terminated calls to the mobile subscribers that were registered with the S-CSCF that was restarted.

[0034] In providing a solution to the above-noted problem in accordance with the third option, the following assumptions are made:

1) IPv6 is adopted for IP addressing and a subscriber is given a home address at subscription time. This home address is stored in a UMS ~~(User Mobility Server)~~.

2) The subscriber is in an area assigned to an S-CSCF and has registered with it and has provided its' TA, that is, the current address where the subscriber is reachable. Such an address is not the static home address but rather ~~what~~ is ~~called~~ the ~~"Care-Of-Address"~~ Care-of Address. Whenever the S-CSCF has to forward signaling to the mobile subscriber, it uses the Care-of Address. The subscriber has also registered its current Care of Address with its Home Agent.

3) The S-CSCF restarts due to a fault and loses the information about the mobile station.

[0035] The following procedure in accordance with the present invention, as illustrated in Figure 5, may, for example, be used for mobile terminating call delivery when, as illustrated in 1, the S-CSCF crashes and restarts, the S-CSCF has no memory of what mobile stations (MSs) were registered with the S-CSCF and does not have any of the MSs Care of Address addresses:

[0036] When an incoming call at 2 reaches a CSCF in the home network, either from another IP based terminal or from an MGCF (Media Gateway Control Function), the ~~interrogating~~ I-CSCF queries at 3 the UMS based on the alias dialed by the calling party.

[0037] During registration, the UMS has stored information about the S-CSCF and information as to how the mobile subscriber can be reached. More particularly, the UMS has stored the address of the S-CSCF, that is, the address where CC (Call Control) signaling must be forwarded. At this point, two scenarios are possible:

[0038] 1) ~~the~~ The information in the UMS regarding the S-CSCF is still valid; the UMS returns at 4 the address of the S-CSCF and the Subscriber Identity and then forwards the call setup 5 to the ~~Serving~~ S-CSCF.

[-]The S-CSCF, not having information available for the alias to which the call corresponds due to a crash, queries 6 the UMS based on the Subscriber Identity optionally indicating that a restart took place in order to trigger a profile download.

[-]The UMS returns at 5 the Home Address of the ~~mobile subscriber~~ MS.

[-]The S-CSCF forwards at 8 the signaling to the Home Address which is the home agent.

[-]The ~~Home Agent~~home agent receives the packets and forwards them at 10 to the MS using the Care[-] of Address obtained during the Mobile IP signaling exchanged when the Care-of Address was created (the usual procedure in Mobile IP).

[-]When the ~~mobile subscriber~~ MS receives the first packet, it sends at 11 a message to the S-CSCF which sent the packet to update the address indicating the Care of Address as the correct address to be used to reach the subscriber(the usual procedure in Mobile IP) and call control signalling is sent at 12 from the S-CSCF to the MS.

[-] When the call is terminated the subscriber can optionally re-register with the S-CSCF.

[0039] 2) ~~the~~ The information in the UMS is not valid; the UMS returns the Home Address of the mobile subscriber.

[-]The ~~interrogating~~ I-CSCF forwards the signaling to the Home Address.

[-]The Home Agent receives the packets and forwards them to the Care-of Address obtained during the Mobile IP signaling exchanged when the Care-of Address was created (the usual procedure in Mobile IP).

[-]When the mobile subscriber receives the first packet, it sends a message to the ~~interrogating~~ I-CSCF which sent the packet to update the address indicating the Care of Address as the correct address to be used to reach the subscriber (the usual procedure in Mobile IP).

[-] When the call is terminated the subscriber can optionally re-register with a S-CSCF.

[0040] This concludes the description of the example embodiments. Although the present invention has been described with reference to a number of illustrative embodiments, it should be understood that numerous other modifications and embodiments can be devised by those skilled in the art that will fall within the spirit and scope of the principles of this invention. More particularly, reasonable variations and modifications are possible in the component parts and/or arrangements of the subject combination arrangement within the scope of the foregoing disclosure, drawings, and appended claims without departing from the spirit of the invention. For example, the example embodiments of the present invention have been described with respect to currently used networks, such as 3G All-IP mobile networks, and standards for simplicity. It is, of course, understood that the present invention is not limited thereto. In addition to variations and modifications in the component

parts and/or arrangements, alternative uses will also be apparent to those skilled in the art.

~~What is claimed is:~~